PCT / IB 00 / 01419
01.11.00

B00/1419

The Patent Office

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

REC'D 09 NOV 2000
WIPO PCT

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed AHBrewer.

Dated 2 October 2000

Patents Form 1/77

Patents Act 1977
(Rul

THE PATENT OFFICE
22 SEP 1999
RECEIVED

The Patent Office

23SEP99 E478792-8 D02246
P01/7700 0.00 - 9922451.1

Request for a grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. **Your reference** — PO ... TAG

2. **Patent application number** *(The Patent Office will fill in this part)* — 9922451.1

3. **Full name, address and postcode of the or of each applicant** *(underline all surnames)*

   Viostyle Limited
   Margarita House
   15 Them. Dervis Avenue
   Nicosia
   Cyprus

   Patents ADP number *(if you know it)* — 7746134001

   If the applicant is a corporate body, give the country/state of its incorporation — Cyprus

4. **Title of the invention** — Filtering element for treating liquids, dusts and exhaust gases of internal combustion engines

5. **Name of your agent** *(if you have one)* — D YOUNG & CO

   "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

   21 NEW FETTER LANE
   LONDON
   EC4A 1DA

   Patents ADP number *(if you have one)* — 59006

6. **If you are declaring priority from one or more earlier patent applications, give the country and date of filing of the or each of these earlier applications and (if you know it) the or each application number**

Country	Priority application number *(if you know it)*	Date of filing *(day/month/year)*

7. **If this application is divided or otherwise derived from an earlier UK application, give the number and filing date of the earlier application**

Number of earlier application	Date of filing *(day/month/year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

No

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	None
Description	6
Claims*(s)*	1
Abstract	1
Drawing*(s)*	1

10. If you are also filing any of the following, state how many against each item.

Priority documents	None
Translations of priority documents	None
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	None
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	1
Any other documents *(please specify)*	None

11. I/We request the grant of a patent on the basis of this application.

Signature

D YOUNG & CO
Agents for the Applicants

Date

22 September 1999

12. Name and daytime telephone number of the person to contact in the United Kingdom

Neil Nachshen 020 7353 4343

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505

b) Write your answers in capital letters using black ink or you may type them

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separte sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you answered 'Yes' Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) For details of the fee and ways to pay please contact the Patent Office.

DUPLICATE

"Filtering element for treating liquids, dusts and exhaust gases of internal combustion engines"

***

The present invention concerns filtering devices in general and, more particularly a filtering element for treating liquids, dusts and also gases. The present invention was developed with particular attention to its possible use for filtering liquids in general that contain material to be removed, a case in point being lubricating and cooling liquids employed in mechanical processing, and also for filtering dusts in environments in general, especially industrial environments, steel works for example, and for processing the exhaust gases of the internal combustion engines of motor vehicles and, more particularly, oxidizing the anhydrides present in these gases.

The object of the invention is to realize a filtering element that can be efficaciously used in all the aforesaid applications and can be readily cleaned from time to time, should this prove necessary, avoiding the difficulties deriving from clogging and the need for replacing the element.

According to the present invention, this object can be attained thanks to a filtering element comprising a tubular and generally cylindrical body with a perforated wall intended to be crossed by a fluid to be filtered, essentially characterized in that the said wall presents a laminar structure obtained by means of a controlled galvanic electroforming process with selective deposition of nickel on a matrix arranged at the cathode, the said laminar structure having an outer surface which is smooth and devoid of roughness and being formed with micro-holes that have walls with rounded edges and diameters depending on the length of time in the galvanic bath and the desired thickness of the laminar structure, preferably smaller than 30 micron.

When used for the filtering of liquids, the filtering element in accordance with the invention can be advantageously applied, possibly together with several other similar filtering elements, to constitute a self-cleansing filtering device.

The invention will now be described in greater detail by reference to this specific application, which is represented in the attached drawings - furnished solely by way of example and not to be considered limitative in any manner or wise - where:

Figure 1 is a vertical section through the plane of a diameter and schematically illustrates the structure of a filtering device that incorporates filtering elements in accordance with the invention;

Figure 2 is a partial and schematic view that shows, at a substantially larger scale, the section of a portion of the filtering element in accordance with the invention during its production process; and

Figure 3 shows a fragmentary plan view as seen from above and in the direction of the arrow III of Figure 2.

The reference number 1 in Figure 1 indicates the whole of a filtering device intended to be interposed between an inlet line I of a liquid to be filtered (for example, a cooling emulsion of oil and water used during the carrying out of a machining operation and containing shavings and other particles of the material to be removed) and an outlet line O that the liquid, now filtered and cleansed of the particles it contained, crosses in order to be re-inserted in the cooling circuit.

The filtering device 1 is substantially made up of a closed shell 2 (which is normally metallic) that is provided with an inlet opening 3 in communication with the inlet line I and an outlet opening 4 in communication with the outlet line O.

The inlet opening 3 and the outlet opening 4 are associated with, respectively, the electric valves indicated schematically by the reference numbers 5 and 6, which make it possible for the openings 3 and 4 to be selectively opened and closed.

The shell 2, which is preferably of a circular section, has a lower portion 7 in the form of a funnel that converges onto a lower discharge opening 8 that is likewise controlled by an electric valve 9.

The upper part of the shell 2 is closed by a selectively removable lid 10 on which there is mounted a pneumatic distribution device 11 that can be supplied with pressurized air from a source 12.

The reference number 13 indicates a flange that extends transversely inside the shell 2 and in contact with its upper extremity. The flange 13 divides the volume within the shell 2 into a first chamber 14, which corresponds roughly to the middle and lower portion of the shell 2, and a second chamber 15 that corresponds roughly to the upper portion of the said shell 2.

The first chamber 14 communicates with the inlet opening 3, while the second chamber 15 communicates with the outlet opening 4.

The flange 13, which acts as a partition baffle within the shell 2, carries a plurality of filtering members 16, each of the said filtering members being substantially made up of an elongated support in the form of a hollow and therefore permeable cylinder, the upper end of which is connected in a watertight manner to the flange 13, while its lower end is closed and so arranged as to coincide substantially with the lower funnel portion 7 of the shell. Within the first chamber 15 each of the filtering members 16 therefore extends downwards from the flange 13. The internal cavity of each of the said filtering members 16 communicates de facto with the second chamber 15.

Each of the filtering members 16 also comprises an external filtering element 17 that consists of a thin and flexible cylindrical sheath, which may also be slightly conical, open at both ends.

As can be seen more readily in the enlarged views of Figures 2 and 3, each filtering element 17 has a micro-perforated laminar structure and is therefore porous, where the perforations, indicated by 17a, have a plan (or section) form that may be polygonal, generally hexagonal, or rhomboidal and walls that have rounded surfaces and taper from the outer face of the lamina towards the inner face. More generally, the micro-holes 17a may have a form that simply converges or simply diverges from the outer face to the inner face of the lamina and may also be of a converging-diverging form. The said micro-holes 17a may have diameters depending on the length of time in the galvanic bath and the desired thickness of the laminate. One has to do with dimensions that will normally be less than 60 microns, preferably less than 30 microns, and could be, for example, of the order of 3 - 4 microns. These diameter sizes may either be homogeneous or differ from one region to another, in accordance with appropriate optimization criteria.

It is, of course, possible to use filtering elements 17 in which the hole sizes have to be adapted to specific application requirements and are therefore different from the ones indicated hereinabove.

In general, the density of the micro-holes 17a may be comprised, for example, between 10 dots/mm and 2 dots/mm, while the thickness of the lamina may be of the order of 80 microns to 500 microns.

The micro-perforated filtration lamina 17 is realized by means of a controlled galvanic electroforming process, with selective deposition of nickel on a matrix at the cathode, appropriately prepared for surface conditioning of the lamina 17. In particular, the said matrix, generically indicated by the letter M, has a hollow imprint, sometimes referred to as "inkpot", suitable fo creating the conductive zones for the electroforming process and the zones rendered insulating by filling with dielectric resins that constitute the electroformed holes, and eventually levelled and chrome-plated. In this way the nickel formed on the matrix M during the electro-galvanization process becomes deposited in the surroundings of the imprints S , thus forming the micro-holes 17a . The surface of the lamina 17 realized in this manner has its outer surface, i.e. the surface that during the formation process is turned towards the matrix M , perfectly smooth and devoid of all roughness.

Purely by way of example, the material employed for the depositing the nickel on the matrix M at the cathode could have the following composition:

- nickel sulphate	300 g/l
- nickel chloride	28 g/l
- boric acid	50 g/l
- MAGNUM/RT (BL 251) additive	1 ml/l
- 1.3.6 naphthalenetrisulphonic acid trisodic salt	7 g/l

The operating conditions for the galvanization process, again purely by way of example, could be as follows:

- temperature:	52 - 56°C
- electrometric pH:	4.4 - 4.8
- cathode movement:	obligatorily rotational
- cathode rotation speed:	80 - 90 m/min
- filtration:	continuous, on activated carbon

As far as the number of the filtering members 16 and related filtering elements 17 in accordance with the invention is concerned, the choice will be made on the basis of the specific requirements of each particular application, since it is also possible, whenever appropriate, to use no more than a single filtering member 16 .

Each filtering member 16 contains in a generically axial position a pneumatic duct 18 which is connected to a air distributor 11 and is provided with a series of air-blowing orifices arranged at different levels, each orifice being equipped with an appropriate valve not shown on the drawings. The reference number 22 identifies an electronic unit that controls the functioning of the valves 5 , 6 and 9 of the pressurized-air source 12 and the distributor 11 in such a manner as to produce an orderly sequence of filtering phases and cleaning phases of the device 1 . In the embodiment here illustrated, the switching between the two phases is controlled by the unit 22 as a function of the signal generated by a barometric sensor 23 that senses the fluid pressure gradient existing between the inlet opening 3 and the outlet opening 4 , that is to say, the so-called loss of head of the fluid circuit through the filtering device 1 .

During the filtering phase, the valve 9 is closed and the pressurized-air source 12 is disactivated. The valves 5 and 6 , on the other hand, are maintained in their open positions, so that the fluid to be filtered can penetrate into the interior of first chamber 14 and subsequently pass into the second chamber 15 by passing through the micro-holes 17a of the elements 17 of the filtering members 16 . As a result of the previously described dimensions of these holes, the solid material (shavings, dirt and slags in general) dragged along by the liquid will be held back on the outer surface of the filtering elements 17 , while the filtered fluid will accumulate inside the chamber 15 and eventually leave the filtering device though the outlet opening 4 . The outer surfaces of the filtering elements 17 thus act in the truest sense of the term as accumulation surfaces of the material that is being removed from the fluid subjected to the filtering process.

Due to the gradual accumulation of the material that is being removed, the clear size of the holes 17a of the filtering elements 17 tends to diminish, thus increasing the pressure gradient between the inlet opening 3 and the outlet opening 4 . When this gradient attains some predetermined value, the barometric sensor 23 sends a switching signal to the unit 22 , which thereupon commands the commencement of the cleansing phase.

During this phase the valves 5 and 6 are closed and therefore prevent the liquid that is being filtered from passing through the filtering device 1 .

The valve 9 , on the other hand, remains open and the system 11 , 12 , 18 is activated. The air stream issuing from the orifices of the air ducts 18 impinges violently on the wall of the filtering members 16 and then of the filtering elements 17 , thus detaching the material deposited on the outer surfaces of the latter; this material will therefore drop into the first chamber 14 and eventually exit from the filtering device 1 through the discharge duct 8 .

On completion of the cleansing operation (which is continued for a predetermined interval of time) the unit 22 emits the commands that will cause the system to pass once again into the previously described filtering phase.

It should however be noted that, even though the invention has here been described with specific reference to a filtering device for lubricating and cooling liquids employed in machining operations, it can be applied in an equally advantageous manner to a wide range of fluids, liquids and gases containing contaminating particles that have to be removed or, more generally, are to be treated.

These fluids may include liquids of various kinds, dusts in the atmosphere, and also the exhaust gases of internal combustion engines. In the latter case, however, the purification treatment of the gases does not consist of a filtration, but obviously of an oxidation of the anhydrides present in the exhaust gases following the raising of their temperature during the passage through the micro-holes of the filtering element 17 .

Of course, the filtering or - more generally - the treatment device that makes use of the filtering elements in accordance with the invention will have to be adapted to the different applications, though in a generally conventional manner well within the capacity of a technician specialized in this area. The cleansing system of the filtering device may likewise be different from the one here described with reference to the appended drawings and may include, for example, ultrasonic systems or, in the case of dusts, simple shaking devices. In the case of applications for the treatment of the exhaust gases of internal combustion engines, obviously, there will be no need for a cleansing cycle, because the particulate matter retained by the filtering element in accordance with the invention will simply be released into the atmosphere for the spark ignition cycle and self-burnt in the case of Diesel cycle.

Naturally, the construction details and the embodiments may be extensively varied with respect to what has here been described and illustrated without thereby going in any way beyond the limits of the present invention as set out in the claims that follow.

CLAIMS

1. A filtering element (17) comprising a tubular and generally cylindrical body with a perforated wall intended to be crossed by a fluid to be treated, characterized in that it has a laminar structure obtained by means of a controlled galvanic electroforming process with selective deposition of nickel on a matrix (M) arranged at the cathode, the said laminar structure having an outer surface that is smooth and devoid of roughness and being formed with micro-holes (17a) that have walls with rounded edges and diameters depending on the length of time in the galvanic bath and the desired thickness of the laminar structure.

2. A filtering element in accordance with Claim 1, characterized in that the said micro-holes (17a) have diameters generally smaller than 30 microns.

3. A filtering element in accordance with Claim 1 or Claim 2, characterized in that the said micro-holes (17a) have a polygonal or rhomboidal form.

4. A filtering element in accordance with any one of the preceding claims, characterized in that the said micro-holes (17a) have diameters of the order of 3-4 microns.

5. A filter element comprising a perforated structure of nickel deposited on a matrix, the structure having a generally smooth outer surface and with micro-holes having walls with rounded edges.

6. A method of forming a filter element, comprising electro-deposition of nickel on a matrix arranged as a cathode in a galvanic bath, to form a perforated structure with micro-holes that have walls with rounded edges and diameters depending on the length of time in galvanic bath.

7. A filtering element, or a method of production, being substantially as described and illustrated and for the objects specified herein.

"Filtering element for treating liquids, dusts and exhaust gases of internal combustion engines"

ABSTRACT

A filtering element (17) for treating liquids, dusts and exhaust gases of internal combustion engines and comprising a tubular and generally cylindrical body with perforated walls having a laminar structure obtained by means of a controlled galvanic electroforming process with selective deposition of nickel on a matrix. The said laminar structure has an outer surface that is smooth and devoid of roughness and the micro-holes (17a) have walls with rounded edges and diameters of the order of 3 - 4 microns.

(Figure 2)

Fig. 1

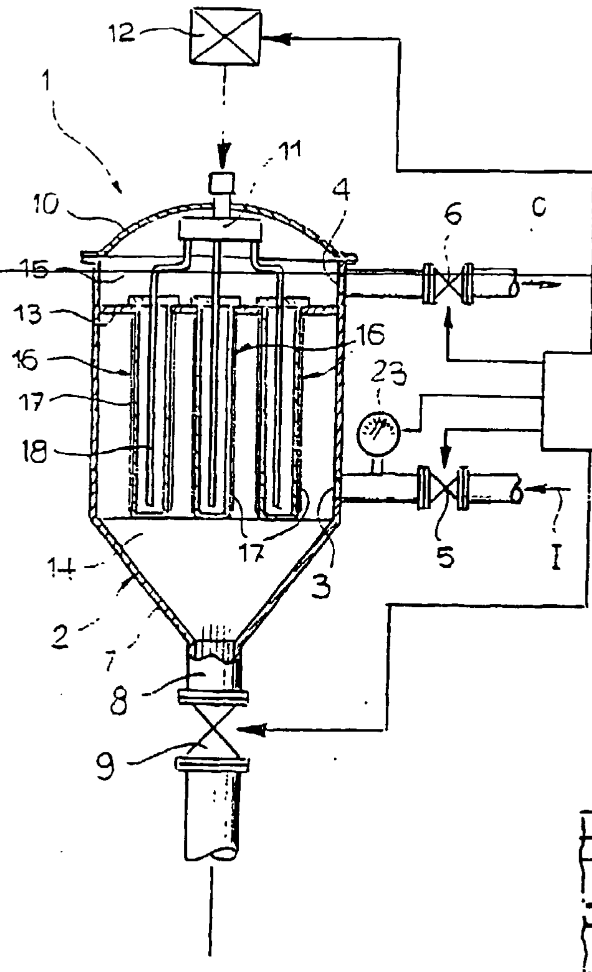

Fig. 3

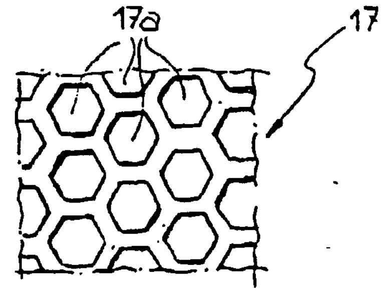

Fig. 2